

Medicine Bow Landscape Vegetation Analysis (LaVA) Project
Biological Assessment and Biological Evaluation of Plant Species
Medicine Bow - Routt National Forests and Thunder Basin National Grassland
Laramie, Wyoming

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04/24/2018

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I. INTRODUCTION

The purpose of this biological evaluation is to analyze and determine the likely effects of the alternatives on federally listed species (endangered, threatened, and proposed), Forest Service sensitive species (FSM 2670.31-2670.32) and species of local concern.

This Biological Evaluation (BE) conforms to legal requirements set forth under section 7 of the Endangered Species Act (ESA) (19 U.S.C. 1536 (c), 50 CFR 402.12 (f) and 402.14). Section 7(a) (1) of the ESA requires federal agencies to use their authorities to further the conservation of listed species. Section 7(a) (2) requires that federal agencies ensure any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of federally-listed species, or destroy or adversely modify designated critical habitat.

Forest Service policy requires that a review of programs and activities, through a biological evaluation (BE), be conducted to determine their potential effect on threatened and endangered species, species proposed for listing, and sensitive species (FSM 2670.3). Under the ESA, a Biological Assessment (BA) must be prepared for federal actions that are “major construction activities” to evaluate the potential effects of the proposal on listed or proposed species. The contents of the BA are at the discretion of the federal agency, and will depend on the nature of the federal action (50 CFR 402.12(f)). A BE may be used to satisfy the ESA requirement to prepare a Biological Assessment. Preparation of a Biological Evaluation as part of the NEPA process ensures that TEPS species receive full consideration in the decision-making process.

II. DESCRIPTION OF THE PROPOSAL

For a detailed description of the proposed action and each of the alternatives please see the the Medicine Bow Landscape Vegetation Analysis Project Issues and Alternatives Memo dated March 9, 2018, the Revised Issues and Alternatives Memo dated March 28, 2018, and the Draft Environmental Impact Statement, July 2018.

Project Area

The project area encompasses approximately 615,230 acres of National Forest System (NFS) lands and 150,000 – 350,000 vegetation treatment acres located in Albany and Carbon counties in South Central Wyoming (Figure 6). Proposed activities would occur on NFS lands managed by the Medicine Bow National Forest, Laramie and Brush Creek/Hayden Ranger Districts, within the areas designated by the Secretary of Agriculture under the amended Healthy Forests Restoration Act. For purposes of analyzing the Proposed Action, the project area is divided into 14 Accounting Units which are discussed in more detail in Chapter 2 (see Figure 1).

Forest Plan

Medicine Bow National forest management direction is provided by the 2003 LRMP (forest plan). Development of forest plans is required by the rules implementing the Forest and Rangeland Renewable Resources Act of 1974 as amended by the National Forest Management Act of 1976. Forest Plans set forth goals and objectives of management actions and further direct these actions through standards and guidelines. The LAVA project analysis tiers to the 2003 Revised LRMP FEIS (2003b). Chapter 2 of the 2003 LRMP assigns a management emphasis to each management area within the Medicine Bow

National Forest. Land management practices that are appropriate in one management area (MA) may be constrained in another. The LAVA project area includes all or parts of 22 MAs (Figure 1).

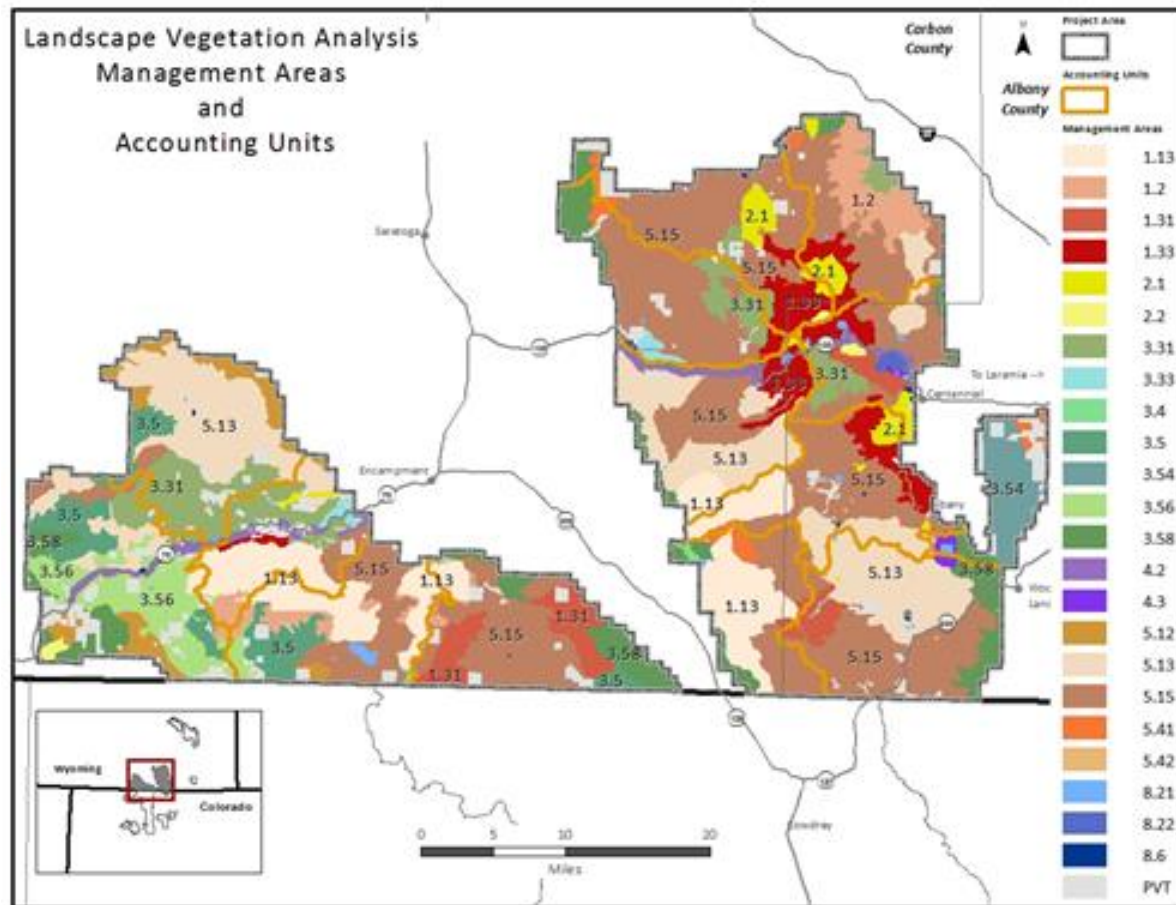


Figure 1. Management Areas within the LaVA Project Area

Purpose of and Need for Action

The purpose of the LAVA Project is to respond to changed forest vegetation conditions presented by the mountain beetle epidemic experienced on the Medicine Bow National Forest. The need for the project is defined by existing and desired vegetation conditions and the threats to forest values they pose. The approach is to actively manage forest vegetation using tree cutting, prescribed burning, or hand treatments, consistent with the goals outlined in the Governor's Task Force on Forests (Final Report, 2015), Western Bark Beetle Strategy (July 2011), Wyoming Statewide Forest Resource Strategy (2010), the Healthy Forests Restoration Act and Farm Bill Amendment (2003 and 2014), and Medicine Bow Forest Plan (2003). Goals include promoting recovery from the insect infestations, improving the resiliency of green stands to future disturbances, helping protect forested areas on adjacent private and state land, and providing for human safety. General goals will be adapted during implementation to fit conditions at the local project scale where treatments are needed based on Forest Plan direction, foreseeable conditions, local environmental, and social and economic concerns.

The discussion in the previous sections of Chapter 1 identified gaps between the existing and desired condition of the Forest within the LAVA project area as follows:

- The MPB epidemic has moved lodgepole pine stands to an existing condition of lodgepole pine structural stages being well below the 5th decade desired conditions provided in Forest Plan direction. Given the widespread lodgepole mortality, there is a need to accelerate regeneration through vegetation treatments to reach desired conditions and diversity of cover types in order to reach management area prescriptions, standards, and guidelines. This diversity would provide resilience to future insect and disease epidemics.
- The existing condition of lodgepole pine mortality has moved the Forest away from the desired conditions provided for maintaining a suitable timber base. Within the suitable timber base, there is a need to continue to provide treatments which support the future regeneration of lodgepole pine in order to meet management area prescriptions, standards, and guidelines which require the provision of forest products.
- The existing condition of overhead hazard trees, caused by the MPB epidemic, does not conform to the desired condition of providing for public and employee safety and risk of wildfire in WUI areas.
- The MPB epidemic has created an existing condition of heavy fuels in lodgepole pine stands which does not conform to the desired conditions of providing for the protection of communities, infrastructure, and municipal watersheds from wildfires.
- The heavy mortality in mature lodgepole pine is moving the existing condition away from the desired condition of providing biodiversity on the Forest including the reduction of suitable habitat for Canada lynx. Given this reduction, there is a need to accelerate habitat recovery.

Alternatives to be Analyzed in Detail

- Alternative 1 – No Action
- Modified Proposed Action

Alternative 1: No Action

The National Environmental Policy Act (NEPA) requires the study of the No Action Alternative and directs that this alternative be used as a basis for comparing the effects of the Proposed Action and other alternatives.

The No Action Alternative assumes that the Modified Proposed Action would not be implemented within the analysis area. This alternative represents no attempt to actively respond to the issues, the purpose and need for action, or concerns identified during public scoping and public engagement sessions for this project. There would be no effort to modify existing conditions, unless authorized by other decisions. Current management plans would guide management of the project area and ongoing management programs would be implemented. These other projects would proceed under separate NEPA analyses or authorities. Other related projects which are currently authorized will be noted in EIS Chapter 1 under “Other Related Efforts.”

Alternative 2 - Modified Proposed Action

The following modifications have been made to the Proposed Action to address concerns raised during the July 2017 scoping effort:

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- Eliminating the 10 miles of permanent road construction proposed in the July 2017 Scoping Document; and
- Developing a new Treatment Opportunity Area (TOA) map to better reflect where temporary road construction is and is not allowed, per Forest Plan direction.

The Forest Service proposes to conduct vegetation management activities on NFS lands, including inventoried roadless areas, within the Sierra Madre and Snowy Range Mountain Ranges of the MBNF. Vegetation management activities, including prescribed fire, mechanical, and hand treatment methods, could be applied on up to 360,000 acres to make areas more resilient to future disturbance; protect, restore, and enhance forest ecosystem components; supply forest products to local industries; provide for human safety; reduce wildfire risk to communities, infrastructure, and municipal water supplies; and improve, protect, and restore wildlife habitat. Specific treatments would be developed and authorized for implementation over a 10-year period beginning in 2018 and would be completed within approximately 15 years of the project decision. A combination of commercial timber sales, service contracts, stewardship contracts, cooperative authorities, partner capacity, and Forest Service crews would be used to implement the project.

The Modified Proposed Action is intended to address continually changing forest conditions by incorporating principles of adaptive management. In doing so, this alternative proposes an acreage ceiling of up to 360,000 acres that could be treated within pre-established TOAs (613,000 acres) rather than identifying site-specific treatment units. During project implementation, the Forest Service would cooperate with other agencies, local governments, interested stakeholders, and organizations to identify specific treatment units. Specific objectives of each treatment unit would be determined prior to any ground-disturbing activities using existing vegetation conditions and a series of project-developed field review forms. The sum of all treatments, regardless of roadless status, would not exceed 360,000 acres and would be dependent on such things as staffing, funding, site-specific resource conditions, and project design features.

Specific activities associated with the Modified Proposed Action include:

- Up to 95,000 acres of stand initiating or even-aged treatment methods.
- Up to 165,000 acres of uneven-aged or intermediate treatments.
- Up to 100,000 acres of other vegetation treatments, including prescribed fire, mastication, and hand thinning
- Constructing not more than 600 miles of temporary road, as necessary, to access treatment areas.

Adaptive Management Treatment Options

A variety of management options including, but not limited to, clearcutting/coppice; group and individual tree selection; salvage; mastication; sanitation; thinning; and prescribed fire would be used to achieve resource objectives identified for individual treatments. Treatment options and resource objectives are described in Attachment D, as outlined below.

Inventoried Roadless Area

Roughly 125,200 acres of Inventoried Roadless Areas have been identified as potential TOAs. Information specific to IRAs is included in Attachments E – G, as outlined below. No temporary road construction would occur in IRAs.

Road/Access Information

The Modified Proposed Action includes constructing no more than 600 miles of temporary road, as necessary, to access treatment areas. Temporary roads would be for administrative use only (i.e., they would be managed as closed to the public) and would be reclaimed within 3 years of project completion to preclude future motorized use and to restore ecological function in the affected area. Methods for reclaiming temporary roads may include, but are not limited to, re-contouring the road, ripping/scarifying the roadbed, removing culverts, installing drainage features, creating physical barriers to preclude motorized travel, scattering wood/rock debris onto the road, applying seed and mulch to the area, and posting signs.

The alternative also includes utilizing and/or reconstructing existing open and closed NFS roads to access treatment units. Reconstruction may include road blading, culvert installation or replacement, and gravelling. Closed NFS roads would be for administrative access only and would be returned to a closed status with the method of closure being determined at implementation.

Other Activities

Other activities associated with the Modified Proposed Action include, but are not limited to slash treatments (e.g., pile burning, chipping), regeneration surveys, noxious weed control, native grass/forb seeding, and road maintenance associated with implementing vegetation treatments.

Project Design Features and Analysis Assumptions

Project Design Features (PDFs) and Analysis Assumptions have been developed for the LaVA Project to reduce or prevent potential undesirable effects resulting from management activities and to ensure consistent analysis of project effects, respectively. Project Design Features were developed using guidance from such documents as the State of Wyoming Best Management Practices, Watershed Conservation Practices, Forest Plan standards and guidelines, and other environmental protections required by applicable laws, regulations, and policies. The Analysis Assumptions are given here, the Design Features relevant to the conservation of rare plants and native vegetation communities are given in Table 2, and the remainder are included in Attachment H, to the Draft Environmental Impact Statement.

Preliminary Analysis Assumptions:

- No more than 360,000 acres would be treated over the life of the LaVA Project; treatments would occur only in pre-established Treatment Opportunity Areas (TOAs).
- Project implementation would occur year-round.
- Individual treatments would not occur until field reviews have been completed and a responsible official has authorized the treatment.
- Forest Plan Standards would be followed (USDA Forest Service 2003).
- Watershed Conservation Practices (FSH2509.25) would be followed (USDA Forest Service 2006a)
- National Best Management Practices for Water Quality Management on National Forest System Lands, Volume 1: National Core BMP Technical Guide (FS-990a) would be followed (USDA Forest

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Service 2012c)

- Project design and implementation would comply with applicable state and federal laws.
- Deviations from Forest Plan Guidelines are allowed; the effects of and rationale for any guideline deviations would be documented in the LaVA EIS and Record of Decision.
- All temporary roads associated with project implementation would be reclaimed within 3 years of project completion, unless the ID team recommends and a line officer decides, that complete obliteration would cause more damage than a less complete technique.
- System roads will be used whenever possible to avoid the need for temporary road construction. Project implementation will use the minimum amount of temporary road construction necessary to achieve resource objectives.
- Level one roads may be used to access treatment areas. These roads will be closed and returned to level one status after treatments are complete. (Moved from Closed Road DC)
- Existing manmade and natural features will be used, whenever possible, instead of building additional control lines for prescribed fire.
- Vegetation treatments may occur in the water influence zone (WIZ) in wildland urban-interface (WUI) areas. If necessary, specific design features would be developed at the time of implementation to ensure protection of area resources.
- Sedimentation is the water-quality impairment most likely to result from the proposed activities. Roads, especially in close proximity to water are the dominant vector for sediment delivery to stream channels or wetland/fem resources.
- Equivalent Clearcut Acres have been modeled at the 6th level watershed and may not exceed 25% per watershed.

Forest Plan Compliance

Rare plants have protections in the 2003 Medicine Bow National Forest Revised Land and Resource Management Plan (USFS 2003b) standard and guidelines (Table 1). These standards assure that any known or newly discovered populations of Threatened, Endangered, or R2 sensitive plants (collectively 'TESP') or Species of Local Concern (SoLC) species will be protected from direct impacts. This is routinely done by avoiding plant populations using a limited activity buffer which prevents vehicles, including heavy equipment from driving over populations or covering them with woody debris, logs, or other materials.

Table 1. Standards and Guidelines from the Medicine Bow National Forest Land and Resource Management Plan

Biological Diversity	
Guideline #6	During project planning, mitigate impacts to plants of local concern so that continued vigor and existence of the populations is not jeopardized.
Threatened, Endangered and Sensitive Species	
Standard #15	Activities will be managed to avoid disturbance to sensitive species and species of local concern, which would result in a trend towards Federal listing or loss of population viability. The protection will vary depending on the species, potential for disturbance, topography, location of important habitat components and other pertinent factors. Special attention will be given during breeding, young rearing, and other times which are critical for the survival of both flora and fauna.

Additionally, project design features describe how rare plants will be protected during implementation for each specific project. LaVA rare plant design criteria describe the standard no-harvest, no ground disturbance buffer that will be used to protect plants with different rarity status (Table 2). The forest botanist has additional authority under this Design Criteria to specify alternate protection measures for special cases.

Table 2. Design Features in LaVA DEIS relevant to the conservation of rare plants, rare plant habitats and native vegetation

HYDROLOGY and WET AREAS	
OBJECTIVE: Maintain long-term ground cover, soil structure, water budgets, and flow patterns of wetlands to sustain their ecological functions.	
#1	<u>Fens:</u> Treatment will not occur in fens. In addition, fens will be protected by a 300 foot limited action buffer in which heavy equipment use will be prohibited.
#1a	<u>Wet Meadows:</u> No operation of heavy equipment, prescribed fire control line, or tree removal will occur in seasonally wet, herbaceous or shrub dominated wetlands, commonly referred to as wet meadows. Wet meadows may also contain trees, but do not include aspen woodlands or riparian gallery forests.
#2	<u>Wetlands, Riparian Areas, and Aquatic Ecosystems:</u> When treating within non-excluded wetlands (see Nos.1 and 1a), riparian areas, and aquatic ecosystems: <ul style="list-style-type: none"> • Restrict temporary roads, landings, or main skid trails as recommended by project resource specialists and approved by the line office. • Hand fall and leave in place OR • Treat with mechanized equipment over a combined surface of 12 inches of frozen ground and snow.
#3	<u>Water Influence Zone (WIZ):</u> A buffer with a minimum horizontal width of 100 feet from the top of each stream bank or edge of wetlands will be applied to perennial and intermittent streams, lakes, reservoirs, riparian areas, and wetlands. However, buffers may vary depending on the type of wet area and site conditions, as agreed upon by project resource specialists. <u>When treating buffers, including WIZ:</u> <ul style="list-style-type: none"> • Equipment use is permitted. • If winter logging occurs, 'Over-Snow' logging DC will apply. • Where feasible, avoid temporary roads, landings, main skid trails, or slash piles in the buffer (WIZ). <ul style="list-style-type: none"> • If the aforementioned are necessary in the WIZ, consult with Forest Service resource specialists. <p>Prior to working within WIZ buffers resource specialists would conduct an assessment to determine site-specific design criteria for the retention of CWD.</p>
#4	Winching of trees across streams is prohibited.
RARE PLANT SPECIES AND SENSITIVE ECOSYSTEMS	
Objective: Maintain ecological integrity and functioning of uncommon, sensitive, or otherwise vulnerable ecosystems. Protect populations of threatened, endangered, and sensitive plant and pollinator species and maintain viability of all plant species in the project area. The follow design criteria were developed to comply with the standards and guidelines in the 2003 Medicine Bow National Forest Revised Land and Resource Management Plan, meet the requirements of the National Forest Management Act and 2012 Final Planning Rule, and conforms to the policy described in Supplement 2600-2017-1 to the Forest Service Manual 2600 – Wildlife, Fish, and Sensitive Plant Habitat Management, Chapter 2670 – Threatened, Endangered, and Sensitive Plants and Animals.	

#1	Rare Plants: Threatened, Endangered, R2 Sensitive and local concern plant species will be subject to a limited action buffer (typically 30 to 100 feet), in which heavy equipment will be prohibited and other treatment activities may be limited, unless otherwise agreed upon by the botanist and District Ranger. Specific buffer distances will depend on plant and habitat characteristics and will be determined at time of discovery.
#2	Meadows: Use of heavy equipment is prohibited in meadows and grasslands unless no other option is available. If heavy equipment use cannot be located outside these areas, Forest Service resource specialists would be contacted prior to implementation to determine whether additional surveys are needed or special requirements are warranted to protect site integrity.
#3	Pollinators: In consultation with Forest Resource Specialists, conduct vegetation management activities in a manner that protects or enhances pollinator habitat. The Pollinator-Friendly BMPS for Federal Lands (draft, May 2015 or finalized version) will be used as a guide.
INVASIVE WEEDS	
OBJECTIVE: Maintain ecological integrity by preventing the introduction and reducing the spread of noxious weeds and invasive plant species in the project area. The following decision criteria were developed to comply with the direction in the 2003 Medicine Bow National Forest Revised Land and Resource Management Plan, Executive Order 13751 – Safeguarding the Nation from the Impacts of Invasive Species, and the USDA-Forest Service Guide to Noxious Weed Prevention Practices.	
	Cleaning of Equipment: Require heavy equipment to be cleaned of mud and plant debris and inspected before vehicles are moved into the project area to prevent introduction or spread of noxious or invasive weed species.
	Vegetative Treatments: Manage vegetative treatments to promote native species and to hinder weed species germination. Prior to implementation, field conditions will be assessed to locate areas with existing infestations of weeds. Areas may be excluded from prescribed burning where there are infestations of fire-proliferating species (i.e. cheatgrass and musk thistle). Weed-infested areas included in burns, with the exception of annual grasses, will be treated with appropriate herbicides or other control methods, as needed, to minimize the spread of weed species pre-treatment and/or post-treatment.
	Seeding: On sites where the probability of erosion or weed infestation is high, disturbed areas will be seeded with an appropriate mix of native plant species per the Guidelines for Revegetation for the Medicine Bow – Routt National Forests and Thunder Basin National Grasslands (signed 2007, as updated). Areas where duff or slash cover the ground, or where natural revegetation is expected to occur quickly, may not need to be seeded. The intent is to intervene only if necessary to establish effective ground cover to control erosion, prevent weeds, and meet scenic objectives.
	Imported materials: All materials imported from off-forest (erosion control materials, soil, mulch, etc.) will be certified weed free or from a weed-free source or area. Forest-level source material (i.e. gravel pits and borrow areas) used for individual treatments will be inspected prior to use to inventory noxious weed presence and treated with herbicide as needed. If inspections cannot occur before treatment implementation, identify where the source came from and monitor for noxious weed presence.

Contract Provisions Benefiting TESP and SoLC Plants

Standard Division B Timber Sale Contract provisions also protect known and unknown populations of Region 2 Sensitive Species and Species of Local Concern (Table 2). If rare plant species or populations are discovered prior to timber harvest, these provisions will be initiated if deemed necessary by the

botanist, and used in a way that guarantees the populations are protected from the direct impacts of timber harvest.

Table 3. Timber Sale Contract standard Division B provisions

Division B Subsection	Provision
B6.24 Protection measures needed for plants, animals, cultural resources, and cave resources	
(a)	Areas, known by Forest Service prior to timber sale advertisement, needing special measures for the protection of plants, animals, cultural resources, and/or cave resources are shown on Sale Area Map and/or identified on the ground, and shall be treated as follows:
(a)(i)	Unless agreed otherwise, wheeled or track laying equipment shall not be operated in areas identified as needing special measures except on roads, landings, tractor roads, or skid trails approved under B5.1 or B6.422. Purchaser may be required to backblade skid trails and other ground disturbed by Purchaser's Operations within such areas in lieu of cross ditching required under B6.6. Additional special protection measures needed to protect such known areas are identified in C6.24.
(a)(ii)	Unless agreed otherwise, trees will not be felled into areas identified as needing special measures.
(a)(iii)	Purchaser shall conduct operations in a manner that does not damage or disturb identified areas. In the event that protective measures identified by the Forest Service are for any reason inadequate, Contracting Officer may delay or interrupt Purchaser's operations, under this Contract, and/or modify this Contract pursuant to B8.33.
(a)(iv)	Purchaser shall immediately notify the Forest Service if its operations disturb or damage any area identified as needing special protection, and shall immediately halt its operations in the vicinity of such area until the Forest Service authorizes continued operations. In the event that Purchaser's operations disturb or damage an area identified as needing special protection, then Purchaser shall reimburse the Forest Service for the full cost and expense of any evaluative and remedial measures undertaken by the Forest Service in connection with such disturbance or damage. Such payment shall not relieve Purchaser from civil or criminal liability under applicable law.
(b)	Nothing contained in this Subsection shall establish, or be deemed to establish any express or implied warranty on the part of the Forest Service (i) that the Forest Service has identified all areas within the Sale Area requiring special protection, or (ii) that measures prescribed by the Forest Service for protection of such areas are adequate.
(c)	Following sale advertisement, additional areas needing special measures for protection may be discovered or identified; protective measures may be revised or newly prescribed; and, additional species of plants and/or animals may be added to federal lists of protected species. In such event, Contracting Officer may delay or interrupt Purchaser's operations, under this Contract, and/or modify this Contract pursuant to B8.33.

Division B Subsection	Provision
(d)	Discovery, by either the Purchaser or the Forest Service, of additional areas, resources, species, or members of species needing special protection shall be promptly reported to the other party.

Affected Environment

The analysis area for the Medicine Bow Landscape Vegetation Analysis Environmental Impact Statement (LaVA EIS) includes all Forest System Lands on the Snowy Range and Sierra Madre, two peninsula ranges of the Southern Rockies in southeastern Wyoming continuous with the forests of the Medicine Bow Mountains and Parks Range in Colorado, respectively. Both mountain ranges are bounded to the north, east and west by sharp transitions to grassland or shrub-steppe ecosystems of the Laramie Basin and Great Divide Basin. The primary vegetation types of the mountain ranges are lodgepole pine forest, spruce-fir forest, mixed conifer forest, aspen, shrublands (primarily sagebrush steppe, but also other types), open grasslands or parks, wetlands and riparian areas. This report is concerned with describing the current status of rare plants and their habitats across these two Forest Service units, focusing on known rare plant populations and areas of concern for botanical resources, such as wetlands, that support a disproportionate number of these species.

Rare Plants on the Medicine Bow National Forest

There are no federally listed threatened or endangered plant species or suitable habitat found on the Snowy Range or Sierra Madres. There are, however, 12 Region 2 Sensitive plant species known from these units, with habitat requirements met for additional species that to date have not been located on these Forest System Lands. In addition, these units support over 40 other rare plants, including Species of Local Concern, a forest-level designation of plant species at risk of becoming locally rare or extirpated due to environmental conditions or forest activities, and rare plant species tracked by the State of Wyoming. These species have not met all the requirements for becoming listed as a Region 2 Sensitive plant (FSM 2670), and are not as rare regionally, but typically possess several factors of rarity, at least on a state-wide or forest-level scale. The LaVA EIS divides the Snowy Range and Sierra Madre in 14 spatial units, referred to as Accounting Units. Table 4 lists the Sensitive and other plant species of concern and gives occurrences by Accounting Unit. The number of known Sensitive plant populations are given by species in each Accounting Unit in the table matrix. Populations vary greatly in size and a single population indicated on the table may represent a small handful of plants in a confined area or up to several hundred plants across several acres. Some populations have been well documented, with plant counts, monitoring, and detailed mapping, others have not, so this table gives population incidence rather than numbers of individuals or other data. The other plant species of concern (PSoC) typically are not as well-documented and monitored as the Sensitive species and Table 4 indicates if PSoC are known to occur in an Accounting Unit or not, but not number of populations present because this information is not consistently known or reliable. Data for this table has been compiled using current and historic Forest Service field surveys, typically project driven and conducted by Forest Service botanists, seasonal field botanists, and Enterprise contractors as well as by third party contractors and environmental consultants. Additionally, this table incorporates data on rare plants collected by the botanists and ecologists of Wyoming Natural Diversity Database (WYNDD), and shared with the Forest Service by WYNDD and the State of Wyoming.

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Table 4. Rare plant occurrences and number of populations (for Sensitive species only) by Accounting Unit

Sensitive Species	Code	JS	SB	BP	GH	BB	RM	BK	CB	NC	WF	FD	PP	FW	OS
Park milkvetch ^W <i>Astragalus leptaleus</i>	ASLE9					1									
Lesser panicle sedge ^W <i>Carex diandra</i>	CADI4						2			1					
Elliptic spikerush ^W <i>Eleocharis elliptica</i>	ELEL4		1				1								
Dropleaf buckwheat ^{SS} <i>Eriogonum exilifolium</i>	EREX2					1		1							
Slender cottongrass ^W <i>Eriophorum gracile</i>	ERGR8														2
Plain's rough fescue ^{SS} <i>Festuca halli</i>	FEHA3											1			
Rabbit Ear's gilia ^{SS} <i>Ipomopsis aggregata ssp. weberi</i>	IPAGW	1	3												
Colorado tansyaster ^{SS} <i>Machaeranthera coloradoensis</i>	MACO3			1		2									1
Arctic raspberry ^{OG} <i>Rubus arcticus ssp. acaulis</i>	RUARA2													1	
Silver willow ^W <i>Salix candida</i>	SACA4									2					3
Sphagnum moss ^W <i>Sphagnum angustifolium</i>	SPAN11						1								
Lesser bladderwort ^W <i>Utricularia minor</i>	UTMI						1			2					
Plant Species of Concern	Code	JS	SB	BP	GH	BB	RM	BK	CB	NC	WF	FD	PP	FW	OS
Muskroot ^{OG} <i>Adoxa moschatellina</i>	ADMO													x	
American alpine ladyfern ^{OG} <i>Athyrium distentifolium var. americanum</i>	ATAM									x					

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Ragleaf bahia ^{SS} <i>Bahia dissecta</i>	BADI													X	
Mingnan moonwort <i>Botrychium minganense</i>	BOMI	x					x								
Pale moonwort <i>Botrychium pallidum</i>	BOPA12						x								
Buxbaum's sedge ^W <i>Carex buxbaumii</i>	CABU6				x										
Deer sedge ^W <i>Carex hallii</i>	CAHA3					x				x					x
Purple marshlocks ^W <i>Comarum palustre</i>	COPA28			x			x				x				
Showy draba <i>Draba spectabilis</i> var. <i>oxyloba</i>	DRSPO			x											
Western oak fern ^{OG} <i>Gymnocarpium dryopteris</i>	GYDR		x												
Slender tube scarlet gilia ^{SS} <i>Ipomopsis aggregata</i> ssp. <i>tenuituba</i>	IPTET2		x	x			x								
Northern white rush ^W <i>Juncus albescens</i>	JUAL2								x						
Thread rush ^W <i>Juncus filiformis</i>	JUFI				x	x									
Narrowleaf bladderpod ^{SS} <i>Lesquerella parvula</i>	LEPA7					x									
Hall's ragwort <i>Ligularia bigelovii</i> var. <i>halli</i>	SEBIH					x				x		x		x	
Wood lily <i>Lilium philadelphicum</i>	LIPHP													x	
Slender-leaved lovage <i>Lisgusticum tenuifolium</i>	LITE1				x	x									
Northern twayblade ^{OG} <i>Listera borealis</i>	LIBO4										x				

Biological Evaluation of Plant Species

Heartleaf twayblade ^{OG} <i>Listera cordata</i>	LICO6	x		x		x	x	x	x					x	
Broadlipped twayblade ^{OG} <i>Listera convallarioides</i>	LICO5					x		x		x					
Marsh felwort ^W <i>Lomatogonium rotatum</i>	LORO					x				x				x	x
Stiff clubmoss ^{OG} <i>Lycopodium annotinum</i>	LYAN2													x	
Rusby's blazing star ^{SS} <i>Mentzelia rusbyi</i>	MERU		x											x	x
Alpine oreoxis ^{SS} <i>Oreoxis alpina</i>	ORALA					x				x					x
Falsegold groundsel <i>Packera pseud aurea var. flavula</i>	PAPSF		x												
Sagebrush beardstongue ^{SS} <i>Penstemon cyathophorus</i>	PECY6			x		x			x				x		
White phacelia ^{SS} <i>Phacelia alba</i>	PHAL9													x	x
Rocky Mountain phacelia ^{SS} <i>Phacelia denticulata</i>	PHDE2													x	x
Bluntleaved orchid ^{OG} <i>Platanthera obtusata</i>	PLOB	x				x								x	
Rocky Mountain polypody ^{OG} <i>Polypodium saximontanum</i>	POSA19												x		
Northern hollyfern ^{OG} <i>Polystichum lonchitis</i>	POLO4			x											
Whiteveined wintergreen ^{OG} <i>Pyrola picta</i>	PYPI2	x		x		x									
Curlyhead goldenweed <i>Pyrocoma crocea var. crocea</i>	PYCRC	x	x					x	x		x				
Pale blue-eyed grass ^{SS} <i>Sisyrinchium pallidum</i>	SIPA11														x

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Small bur-reed ^W <i>Sparganium natans</i>	SPNA						X	X			X				
Sphagnum moss (various species) ^W <i>Sphagnum spp.</i>	SPHAG2					X				X	X	X		X	
Rolland's bulrush ^W <i>Trichophorum pumilum</i>	TRPU18									X					X
Pacific trillium ^{OG} <i>Trillium ovatum ssp. ovatum</i>	TROVO2			X	X	X									
Squashberry ^{OG} <i>Viburnum edule</i>	VIED											X		X	

Accounting Units: JS = Jack Savery, SB = Sandy Battle, BP = Battle Pass, GH = Green Hog, BB = Big Blackhall, RM = Rock Morgan, BK = Bow Kettle, CB = Cedar Brush, NC = North Corner, WF = West French, FD = French Douglas, PP = Pelton Platte, FW = Fox Wood, OS = Owen Sheep

Superscript Habitat Indicators: W = found in wetlands and fens, OG = found in old growth and mature forests, SS = found in sagebrush steppe and foothills areas. Species without habitat indicators are not found in habitats indicated or are found in multiple habitat types.

Habitats and Ecosystems that support Rare Plants

As can be seen in Table 1, rare plants are not evenly distributed or equally likely to be found between Accounting Units (AUs). This is result of a complex combination of vegetation type, elevation, topography, geologic history, and other factors. For example, AUs with vegetation types uncommon on the Medicine Bow National Forest, such as the alpine tundra/fellfield in North Corner AU, have many rare species compared to AUs primarily composed of common montane lodgepole pine forest. Another example is Sheep Mountain, which makes up a majority of the Owen Sheep AU. Due to the position and geologic history of this mountain, it has retained relictual circumboreal wetland taxa from the last ice-age in two different drainages. Other AUs have the same type of wetlands at the same elevation as Sheep Owen, but lack those disjunct taxa as a result of glacial activity and other factors. However, this discussion will not focus on why rare plants occur in certain habitats, but where we are most likely to find them and consequently which habitats, ecosystems, and Accounting Units are areas of concern for botanical resources.

Areas of Concern for Botanical Resources

Wetlands

For the sake of this discussion, the term wetland will be used to describe the full suite of wetland types including wet meadows, fens, riparian areas, seeps and springs, and any other habitat that meets the soil, water, and/or vegetation requirements of Section 404 of the Clean Water Act.

Wetlands on the Medicine Bow National Forest comprise approximately 4% of the landscape but support a disproportionate number of plant species. A recent assessment from Wyoming Natural Diversity Database (WYNDD 2017) found that 49% of the flora in the state of Wyoming may be found in wetland habitats. This represents a large portion of our floral biodiversity and includes many rare, disjunct, and endemic plant species. In fact, 6 of the 12 Sensitive species found in the analysis area are found only in wetlands. These habitats are also vitally important for the ecosystem functions they provide to the forest and to human populations including nutrient cycling, water storage, and carbon sequestration.

In the LaVA analysis area the primary tool for wetland identification at a planning level (in the office) is the National Wetlands Inventory (NWI) spatial layer. This layer uses the Classification of Wetlands and Deepwater Habitats of the United States (Cowardin 1979) to classify wetlands that have been identified and digitized using aerial imagery. This methodology resulted in a fairly coarse map which does accurately identify large wetlands but tends to have high rates of omission for small wetlands and those under the tree canopy. For this reason field surveys typically results in the discovery of additional unmapped wetlands and expands boundaries of mapped wetlands. In addition, errors of commission exist in which some dry meadows or shrublands are mapped as wetlands, but those types of errors are less frequent.

Though imperfect, the NWI is the best tool we have for identifying wetlands in the LaVA analysis, a primary area of concern for botanical resources. In order to protect floral biodiversity, rare plants, and vital ecosystem functions, I recommend avoiding project activities that include the use of heavy equipment and extensive/complete canopy removal in all wetlands, mapped and unmapped. These activities can damage or destroy plants, physically alter the water table, or change the water budget by drastically affecting the evapotranspiration rate. Additionally, since our wetlands are poorly mapped and since the surrounding area is known to contribute to wetland health, a buffer around wetlands should also be protected from ground disturbing activities and adverse impacts. These actions would not only protect botanical resources, but would aid compliance with law, regulation and policy, including the

Medicine Bow National Forest Land and Resource Management Plan and the Watershed Conservation Practices Handbook.

Fens

Fens are a specific type of wetland worthy of a separate discussion. Fens are ground-water fed peatlands with water-saturated substrates and an accumulation of at least 30 cm of peat (organic soil material). Fens are ancient ecosystems, relict wetlands from the last glaciation, and though not common in the lower latitudes of the continental United States, tend to be abundant in the 8,500 – 10,000 foot elevation ranges in the Southern Rockies. Fens have very unique soil, water, and floristic characteristics found nowhere else on the landscape. Like other wetlands, they are important for the support of biodiversity, water storage and carbon sequestration, but fens support an even greater proportion of species and ecosystem services relative to their size on the landscape. 13% of Wyoming state flora is only found in fens, 17% of which represents endemic, rare or disjunct species – meaning the nearest populations of the same species are found hundreds of miles away in boreal or sub-arctic zones. In fact, Wyoming fen flora is a major component of the state and regional disjunct flora and contributes species that are biogeographically exceptional for the state. They also support plant species compositions that are unique to other habitats. The very rarest plant species in Wyoming have the highest fidelity to fens and the 6 wetland dependent Sensitive species mentioned in the previous section are all found in fens. Due to extreme and year-long saturation, fen soils and water tables can be especially vulnerable to disturbance as they are continually soft. Even during winter months the microbial activity often keeps the soil and water from freezing, so winter operations are not effective for protecting this resource.

Many fens are mapped in the NWI, but the classification system used in this mapping project does not specifically or accurately identify which wetlands are fens. It is not possible to use this tool to distinguish fens from other wetlands. However, in 2003 and 2006 several watersheds in the Snowy Range and Sierra Madre were surveyed as part of a fen inventory. This inventory included portions of North Corner, Rock Morgan, West French, French Douglas, Owen Sheep, Battle Pass, and Green Hog AUs and mapped a total of 175 fens. Fens in the target areas were thoroughly and accurately mapped, but the study area comprises less than half of the LaVA analysis area. There are undoubtedly fens in all the AUs, and unfortunately the majority of the analysis area has not been inventoried.

Of all the wetland types in the analysis area, fens are the most important for floristic diversity and are most likely to contain rare plants, including the most exceptionally rare species. They are vulnerable to disturbance from any ground activities due to soft saturated soils and the dependence of vegetation and soils on seasonal water tables. They are also considered irreplaceable because there are no known methods for the creation of new, functional fens. For these reasons, I have specifically identified fens as an area of concern. I recommend that fens receive more conservative treatment than other wetlands and no project activities or operations occur in fens, including hand treatments. I also recommend a larger buffer area around known and newly discovered fens, with at least 300 feet around each fen protected from ground disturbing activities and adverse impacts. These recommendations are consistent with protections suggested in the *Wetlands Protection – Fens* letter from the Forest Service Region 2 office, dated March of 2002.

Old Growth and Mature Forests

The old growth and mature forests of the Medicine Bow National Forest have traditionally supported several rare plant species that thrive on the moist, shaded, and undisturbed forest floor. Rare plants have been found in old growth/mature lodgepole pine and spruce fir forests in both the Sierra Madre and Snowy Range. Some of these areas are ideal rare plant habitat but also ideal timber harvest areas for the LaVA project, making them botanical areas of concern.

Over the past decade insect infestations in both lodgepole pine and Engelmann spruce have killed many trees in large portions of the mature and old growth forest. This high level of tree mortality has opened up the canopy, bringing a lot more light to the forest floor. The rare plants recorded in the old growth and mature forests such as white-veined wintergreen, several orchids, and some ferns are known to reduce in population size and number with increased light conditions. These types of species are commonly referred to as “reducers”, and the extent of the adverse impact the opened canopy will have on each species or known population is not definitively known. Project activities, including logging, have always posed a risk to rare understory plants to some extent, but now the natural, changing conditions of the forest are also having adverse impacts on rare reducers. The resiliency of these species, especially when exposed to multiple perturbations is unknown. For this reason it is vitally important to protect these rare plants from impacts we can control.

Old Growth forests are identified in a forest-wide GIS layer and known locations of rare reducers (and other plants) are housed in a national Forest Service database that is managed on a local level by the forest botanist. There is additional rare plant information in the state owned WYNDD database. Using this information these areas of potential occurrence can be targeted for higher intensity field surveys. As per Forest Service standard operating procedures, all activity areas for the LaVA project will be surveyed for rare plant species prior to implementation, but more scrutiny can be given to areas with suitable habitat. Rare plant species that are discovered within project areas will be protected from ground disturbing activities and heavy equipment, including a limited-action buffer around each population, the size of which will vary based on projects needs and recommendations by the botanist. Also, where possible, the canopy (both living and dead) will remain in place above the rare plants to preserve as much shade for the population as possible. These measures are designed to protect the long term viability of these rare plant species on the Forest and are described in the Design Features.

One benefit from the opening forest canopy is that understory plants species that prefer more light are increasing in population size and number across the forest. These species, which we will call “increasers” may also contain some rare species. Species such as wood lily, curlyhead goldenweed, and others that grow in full sun conditions may increase in the open canopy, but there are not yet any studies showing this effect. What is known is that many of the increasers are common flowering plants with showy, insect and bird pollinated flowers. The past 5 years the understory specifically in the mature and old growth spruce fir forests has become densely colonized with large patches of flowering plants. These areas now important habitat for pollinators, including the rare Western bumblebee, warranted for listing as Threatened under the Endangered Species Act. As part of the LaVA project in order to protect some of this new pollinator habitat from what can be destructive and ground disturbing effects of logging equipment, I recommend patches, areas, or islands of this new habitat remain undisturbed in the analysis area, focusing on areas known to be used by the Western bumblebee (data forthcoming in 2018 by WYNDD). This is especially relevant in AUs with subalpine spruce fir forests that were heavily damaged by the spruce beetle such as North Corner. Since the LaVA project is proposing to treat only a percentage of each Accounting Unit, it is possible to identify important pollinator habitat to exclude from treatment without impacting timber goals. In addition, a new set of recommendations called Pollinator Friendly Best Management Practices for Federal Lands was published in draft form in 2015. This document recommends techniques for timber harvest and thinning that can be used to maintain or enhance existing pollinator habitat while treating in these areas.

Sagebrush steppe and foothills

The sagebrush steppe makes up the lower elevation foothills regions along the outer perimeter of the Snowy Range and Sierra Madre. This shrubby habitat is typically interspersed with herbaceous-dominated grasslands and sparsely vegetated plant communities as well as treed draws, north-facing

slopes and ridges. The un-treed, lower elevation vegetation communities are botanical areas of concern for two reasons. Firstly, these areas support a handful of rare plants, including 2 Sensitive species and several regional and local endemic plant species. Secondly, these areas are highly susceptible to invasion by non-native plants, most notably cheatgrass, which is known to take over landscapes and out-compete native plants, changing the fire regime and soil characteristics. The Owen Sheep AU has the most sagebrush steppe and foothills habitat relative to its area, including many Sensitive and endemic plant populations. The recent Squirrel Creek wildfire on the Owen Sheep AU has shown how quickly cheatgrass can take over in disturbed areas. Vegetation data collected on the Squirrel Creek fire scar recorded areas with over 80% cheatgrass cover and depauperate native vegetation communities 3 years post-fire (Figure 2). Cheatgrass and other weeds can outcompete natives, reduce plant diversity and convert habitats, making areas unsuitable for many native species, especially rare plants which often have very specific habitat requirements.



Figure 2. Above: Squirrel Creek fire scar three years post-fire with no treatment, Below: Same area four years post-fire following fall aerial application of selective herbicide that suppresses cheatgrass.

There is no GIS layer that precisely maps the sagebrush steppe or other untreed habitats of the foothills but aerial imagery and the FSVeg spatial layer (forest-wide coarse vegetation map) can be used to target these areas. Rare plants in these habitats are also identified in the national forest service database and the WYNDD database. Since the sagebrush steppe and foothills is mostly untreed it has not been identified for timber treatments in the LaVA project. However, it has been identified as an opportunity area for prescribed burning, fuels reduction, and habitat modification to benefit big game.

Unfortunately, not only is this area very susceptible to conversion to cheatgrass dominated systems, fire (both prescribed and wildfire) is a disturbance that has been proven to drastically increase the spread of cheatgrass as well as other weeds such as toadflax and thistle when seed sources are present. With no treatment post-fire, these weeds can be expected to cover greater areas and with greater density than in pre-fire conditions. Other ground disturbing activities, such as off-road driving, use of heavy equipment, temporary road construction, and road maintenance can also spread weeds to new areas and increase population density. For these reasons, I do not recommend prescribed fire or any ground disturbing activities in units that are known to contain cheatgrass or other weeds unless a post-

implementation treatment plan (including funding) is in place. Post-implementation treatment may involve the aerial or hand spraying of selective herbicide to treat cheatgrass in prescribed burn areas or backpack/ATV boom spraying of noxious weeds along roadsides, etc. I also recommend excluding rare plants from any prescribed burn units that also contain cheatgrass and other weeds and avoiding rare plants with (mechanized) all ground disturbing activities. This will aid in maintaining rare plant habitats and support the continued viability of these species by helping prevent conversion of these areas into cheatgrass dominated systems. Additional details on prescriptions to maintain viability of rare plant populations can be found in the Design Features.

Information Reconnaissance

A pre-field review was conducted to assemble known information and determine if field surveys were necessary. Locations of proposed management actions and known locations of Threatened, Endangered, Proposed, and R2 sensitive species (collectively 'TESP') and plant species of concern (PSoC) were reviewed prior to field surveys to help focus field surveys in the appropriate plant communities and habitats. Results of other field surveys on the Sierra Madre and Snowy Range were used to help determine habitat for of Threatened, Endangered, Proposed, R2 sensitive species and Species of Local Concern for this project. Information from floristic inventories and from the state of Wyoming was used to help determine plant habitat for this project.

USFS field surveys used for this project were conducted by:

- Former MBRTB Botanists, Kathy Roche and John Proctor from 2000 to 2010
- USFS Enterprise botanists in 2008 and 2011
- Current USFS MBRTB north zone botanist, Katie Haynes 2011 through 2017
- USFS biological field technicians (plants) Greg Pappas and Kyle Bolenbaugh in 2016 and 2017

Data used from non-Forest Service sources includes:

- Inventory of fens and fen vegetation in selected watersheds of the Snowy Range and Sierra Madre conducted by Wyoming Natural Diversity Database (Heidel and Laursen 2003, Heidel and Thurston 2004, Heidel and Jones 2006).
- Rare plant inventories conducted on the Snowy Range and Sierra Madre by Wyoming Natural Diversity Database (Fertig 1993, Jankovsky-Jones et al. 1995, Welp et al. 2000, Heidel and Laursen 2002, Fertig and Thurston 2003, Heidel and Handley 2004, 2006, 2007, Heidel 2017).
- Rocky Mountain Herbarium online database: <http://rmh.uwyo.edu/data/search.php>
- Floristic Inventories performed by University of Wyoming graduate students on the Snowy Range and Sierra Madre (Nelson 1984, Kastning 1990, Lukas et al. 2012).
- Reports, data and publications from the Rocky Mountain Research Station (Alexander et al. 1986, Connell et al. 1994, Regan et al. 1998, Dillon et al. 2005)
- Reports on the plants, vegetation, and vegetation types of the Medicine Bow National Forest by the University of Wyoming faculty and students as a result of cooperative funding with the USDA Forest Service (Jones 1992, Fertig 1993, Jankovsky-Jones et al. 1995, Selmants and Knight 2000).
- Peer-reviewed scientific publications (citations in body of text).

- USDA Forest Service Species Conservation Assessments and Addenda:
<https://www.fs.usda.gov/detail/r2/landmanagement/?cid=stelprdb5206999>

All surveys of treatment units and re-visits of known rare plant occurrences in the project area are planned starting in 2018, after the signing of the decision associated with the LaVA EIS and prior to the start of treatments in these areas. Rare plants will be mapped using a GPS, flagged in the field, and protected from direct project impacts using the methods described in the design features.

All surveys discussed in this document will follow the NRIS protocol. In most cases, reconnaissance efforts will consist of a pre-field review (described here) followed by a field survey, conducted at a time when the presence of the greatest number (most but not all) of sensitive plant species can be detected. Additional time will be spent searching in areas with existing records of rare species occurrences.

III. THREATENED, ENDANGERED, AND PROPOSED SPECIES AND DESIGNATED CRITICAL HABITAT CONSIDERED AND ANALYZED

The U.S. Fish and Wildlife Service's Wyoming Field Office updated its list of threatened and endangered species by forest in May, 2016. This list was used to determine that no federally Threatened, Endangered or Proposed (TES) plant species or designated critical habitat occur in the analysis area but one species occurs downstream and could be affected by water depletions.

The following list includes threatened, endangered, and proposed plant species that may have suitable habitat in the LaVA analysis area of the Medicine Bow - Routt National Forest or are located downstream of the project and could potentially be affected. A pre-field review was conducted of available information to assemble occurrence records, describe habitat needs and ecological requirements, and determine whether field reconnaissance is needed to complete the analysis. Sources of information are described above.

Candidate species have sufficient information on their biological status and threats to warrant a proposal to list as Endangered or Threatened, but development of a listing regulation is precluded by other higher priority listing activities. Species that are candidates for listing under the ESA are automatically placed on the Region 2 Regional Forester's sensitive species list. The analysis and determination of effects for candidate species are included as part of the biological evaluation for sensitive species (the next section of this document).

No further analysis is needed for species that are not known or suspected to occur in the project area, and for which no suitable habitat is present. Table 5 documents the rationale for excluding a species. If suitable but unoccupied habitat is present, then additional survey is needed, or presence can be assumed and potential effects evaluated.

Table 5: Threatened, Endangered and Proposed Species Considered and Evaluated

SPECIES COMMON AND SCIENTIFIC NAME	CONSERVATION STATUS ¹	POTENTIAL TO OCCUR?	RATIONALE FOR EXCLUSION	BRIEF HABITAT AND RANGE DESCRIPTION
Western Prairie Fringed Orchid <i>Platanthera praeclara</i>	T	No	No water depleting activities	Occurs on unplowed, calcareous prairies and sedge meadows often associated with the Platte River. Known from tall grass prairie areas in Nebraska and east, may be affected by water depletions to the Platte River watershed in WY and CO

Biological Evaluation of Plant Species

SPECIES COMMON AND SCIENTIFIC NAME	CONSERVATION STATUS ¹	POTENTIAL TO OCCUR?	RATIONALE FOR EXCLUSION	BRIEF HABITAT AND RANGE DESCRIPTION
				(USFWS 2015, NatureServe 2017).

¹**Status Codes** (USFWS 2016): **E**=federally listed endangered; **T**=federally listed threatened; **P**=federally proposed/candidate for listing

Western prairie fringed orchid was the only Federally Threatened, Endangered, or Proposed plant species identified as having the potential to be impacted by this project (USFWS 2017). However, this species only need be considered for water depleting activities (greater than *de minimus*) to the North Platte, South Platte and/or Laramie River Basins. This project does not involve any water depleting activities. Therefore a determination of **no effect** can be made for Western prairie fringed orchid. No consultation with the US Fish and Wildlife Service was initiated for this species.

IV. SENSITIVE SPECIES CONSIDERED IN THE ANALYSIS

The following list includes sensitive species or their habitats that may occur in the LaVA analysis area of the Medicine Bow - Routt National Forest, or are located adjacent to or downstream of the project and could potentially be affected. A pre-field review was conducted of available information on these species to assemble occurrence records, describe habitat needs and ecological requirements, and determine whether field reconnaissance was needed to complete the analysis. Sources of information are listed above.

The 2017 Region 2 Sensitive Species List consists of 91 species, of which 12 are known to occur in the LaVA analysis area of the Medicine Bow - Routt National Forest (Haynes et al. 2018). Based on the pre-field review 4 additional sensitive species have suitable habitat in the LaVA analysis area and are likely to occur.

No further analysis is needed for species that are not known or suspected to occur in the project area, and for which no suitable habitat is present. Table 6 documents the 16 Sensitive species carried forward in this analysis.

Table 6: Region 2 Sensitive Plant Species Considered and Evaluated

Name	Cons. Status (WY) ¹	Habitat Description	Potential to Occur
<i>Astragalus leptaleus</i> park milkvetch	G3G4 S1	Occurs in hummocky willow cars, sedge dominated wetlands. Known from the Snowy Range, suspected in the Sierra Madre. 7,400-9,800 ft. (Ladyman 2006a).	Known
<i>Carex diandra</i> lesser panicled sedge	G5 S2	Occurs in riparian areas, pond edges and fens. Known from wetlands on the Snowy Range; 9,000-10,000 ft. (Gage and Cooper 2006a).	Known
<i>Carex livida</i> livid sedge	G5 S3	Occurs on floating mats in bogs and fens. Known from wetlands in the Snowy Range; 9,000-10,000 ft. (Gage and Cooper 2006b).	Suitable Habitat Exists
<i>Drosera rotundifolia</i> roundleaf sundew	G5 SNR	Acid fens, floating mats, bogs.. 8,530-9,600 ft. (Ackerfield 2015; Gage & Cooper, 2006c)	Suitable Habitat Exists
<i>Eleocharis elliptica</i> Elliptic spikerush	G5 SNR	Associated thermal seeps/ springs, stock ponds, areas of perennial saturation with flowing water from springs. 6,200 to 7,250 ft (Nellessen 2006)	Known
<i>Eriogonum exilifolium</i> dropleaf buckwheat	G3 S2	Occurs in semi-barren sandy areas with calcareous soils; sparsely vegetated and bunchgrass communities; Known from the Snowy Range, suspected on the Sierra Madre; 6,900 – 8,800 ft.(Anderson 2006a).	Known
<i>Eriophorum gracile</i> slender cottongrass	G5 S3	Fens and subalpine meadows. 7,000-11,140 ft. (Decker et al. 2006).	Known
<i>Festuca hallii</i> plains rough fescue	G4G5 S2	Open montane and subalpine meadows, mountain parks, forest openings. 8,500-12,000 ft. (Anderson 2006b).	Known

Biological Evaluation of Plant Species

Name	Cons. Status (WY) ¹	Habitat Description	Potential to Occur
<i>Ipomopsis aggregata</i> ssp. <i>weberi</i> Rabbit Ears gilia	G5 SU	Rocky, gravelly, open sites and with sagebrush, and other shrub species. Openings in coniferous forest slopes. Endemic. 7,200-10,000 ft. (Ladyman 2004c).	Known
<i>Kobresia simpliciuscula</i> simple bog sedge	G5 S1	Mesic to wet tundra, wet glacial cirques, and rich to extreme rich fens. 8,970-12,800 ft. (Decker et al 2006b).	Suitable Habitat Exists
<i>Machaeranthera coloradoensis</i> Colorado tansy aster	G3 S2	Occurs in sparse, gravelly mountain parks, calcareous sandy soils, and on dry alpine tundra. Known from the Snowy Range and Sierra Madre; 8,400- 12,500.(Beatty et al. 2004).	Known
<i>Rubus arcticus</i> ssp. <i>acaulis</i> dwarf raspberry	G5 S2	Occurs under moderately dense canopies of spruce/fir and lodgepole pine, occasionally on the edges of riparian areas and other willow dominated wetlands. Known from the Snowy Range and suspected on the Sierra Madre; 7,000-10,000 ft.(Ladyman 2006b).	Known
<i>Salix candida</i> sageleaf willow	G5 S2	Occurs in fens and floating mats in cool, boreal forests, valleys and riparian bottoms. Known from the Snowy Range and Pole Mountain; 6,600-10,600 ft.(Decker 2006a).	Known
<i>Salix serissima</i> autumn willow	G5 S1	Fens, some with high pH, in valleys and riparian bottoms. Often on drier edges. Known from the Snowy Range and Pole Mountain 6,800-9,720 ft. (Decker 2006b)	Suitable Habitat Exists
<i>Sphagnum angustifolium</i> Sphagnum moss	G5 S1	Acid fens, float mats 7,000-12,000 ft. (McQueen and Andrus 2007).	Known
<i>Utricularia minor</i> lesser bladderwort	G5 S3	Aquatic, in shallow water, montane and subalpine ponds & fens. (Neid 2006). 6,600-8,600 ft.	Known

¹ **Conservation Status:** **G1=** Critically imperiled globally because of extreme rarity (five or fewer occurrences or very few remaining individuals) or because of some factor making it especially vulnerable to extinction. **G2=** Imperiled globally because of rarity (six to 20 occurrences) or because of factors demonstrably making a species vulnerable to extinction. **G3=Vulnerable** throughout its range or found locally in a restricted range (21 to 100 occurrences) or because of other factors making it vulnerable to extinction. **G4= Apparently secure**, though it may be quite rare in parts of its range, especially at the periphery. **G5= Demonstrably secure**, though it may be quite rare in parts of its range, especially at the periphery. **S1= Critically imperiled** in the state because of extreme rarity (five or fewer occurrences or very few remaining individuals) or because of some factor making it especially vulnerable to extinction. **S2 = Imperiled** in the state because of rarity (six to 20 occurrences) or because of factors demonstrably making a species vulnerable to extinction. **S3= Vulnerable** throughout its statewide range or found locally in a restricted statewide range (21 to 100 occurrences) or because of other factors making it vulnerable to extinction. **S4= Apparently secure**, though it may be quite rare in parts of its statewide range, especially at the periphery. **S5= Demonstrably secure**, though it may be quite rare in parts of its range, especially at the periphery.. **SNR/SU=** Not ranked in state/under review

V. PLANT SPECIES OF CONCERN CONSIDERED IN THE ANALYSIS

The following list includes plant species of concern (PSoC) that may occur in the LaVA analysis area of the Medicine Bow National Forest. A pre-field review was conducted of available information on these species to assemble occurrence records, describe habitat needs and ecological requirements, and determine whether field reconnaissance was needed to complete the analysis. Sources of information are listed in preceding sections.

The 2018 Medicine Bow National Forest Species of Local Concern list consists of 26 species (USFS 2003a), of which 18 are known to occur on the LaVA analysis area on the Medicine Bow National Forest. In addition, there are verified occurrences of 23 other rare plant species that are tracked as Species of Concern or Potential Concern by the Wyoming Natural Diversity Database or have a conservation status of Critically Imperiled or Imperiled in the state of Wyoming. These species have not been classified as a Region 2 Sensitive species and are not listed in the Forest Plan as Species of Local Concern, but they are still vulnerable and thus tracked on the state or forest level. Collectively these groups of rare plants are referred to as plant species of concern (PSoC) in this document. Impacts to these species are avoided, when possible, in order to prevent them from becoming rarer, being extirpated from the Medicine Bow National Forest, or getting listed as Sensitive Species. Finally, there is one Forest Plan Species of Local Concern, brown ladies' slipper (*Cypripedium fasciculatum*), with over 250 recorded occurrences in the project area, with many additional undocumented occurrences. At this time, this species not considered locally rare on the Medicine Bow – Routt National Forests nor considered at risk or imperiled in the state of Wyoming. Consequently, project effects to this species will not be analyzed in this document but overall abundance this species will continue to be monitored to assure maintenance of population levels and long-term viability on the forest.

No further analysis is given for species that are not known to occur in the project area. Table 7Table 7 lists species considered during pre-field review and field reconnaissance and indicates occurrence in the analysis area.

Table 7. MBRTB Plant Species of Concern present in the LaVA project area and carried forward in the analysis

SCIENTIFIC NAME	COMMON NAME	Conservation Status ¹ (WY)	MBNF Species of Local Concern	WYNDD Species of Concern
<i>Adoxa moschatellina</i>	muskroot	S2	√	
<i>Athyrium distentifolium</i> var. <i>americanum</i>	American alpine ladyfern	S2	√	
<i>Bahia dissecta</i>	Ragleaf bahia	S2	√	
<i>Botrychium minganense</i>	Mingan moonwort	S2		√
<i>Botrychium pallidum</i>	pale moonwort	S1		√
<i>Carex buxbaumii</i>	Buxbaum's sedge	S2		
<i>Carex hallii</i>	Deer sedge	S2		√
<i>Comarum palustre</i>	Purple marshlocks	S1S2		
<i>Draba spectabilis</i> var. <i>oxyloba</i>	Showy draba	SH	√	√
<i>Gymnocarpium dryopteris</i>	Western oak fern	S2	√	√
<i>Ipomopsis aggregata</i> ssp. <i>tenuituba</i>	Slender tube scarlet gilia	S1		√
<i>Juncus albescens</i>	Northern white rush	S2	√	√
<i>Juncus filiformis</i>	Thread rush	S2	√	
<i>Lesquerella parvula</i>	Narrowleaf bladderpod	S2	√	

Biological Evaluation of Plant Species

<i>Ligularia bigelovii</i> var. <i>halli</i>	Hall's ragwort	S1	✓	
<i>Lilium philadelphicum</i>	Wood lily	S2		
<i>Lisgusticum tenuifolium</i>	Slender-leaved lovage	S1	✓	✓
<i>Listera borealis</i>	Northern twayblade	S2		
<i>Listera cordata</i>	Heartleaf twayblade	S2		
<i>Listera convallarioides</i>	Broadlipped twayblade	S1S2	✓	✓
<i>Lomatogonium rotatum</i>	Marsh felwort	S2	✓	✓
<i>Lycopodium annotinum</i>	Stiff clubmoss	S2		
<i>Mentzelia rusbyi</i>	Rusby's blazing star	S1		✓
<i>Oreoxis alpine</i>	Alpine oreoxis	S1		✓
<i>Packera pseud aurea</i> var. <i>flavula</i>	Falsegold groundsel	S1	✓	
<i>Penstemon cyathophorus</i>	Sagebrush beardstongue	S2		✓
<i>Phacelia alba</i>	White phacelia	S1	✓	✓
<i>Phacelia denticulata</i>	Rocky Mountain phacelia	S2	✓	✓
<i>Platanthera obtusata</i>	Bluntleaved orchid	S2		
<i>Polypodium saximontanum</i>	Rocky Mountain polypody	S1		✓
<i>Polystichum lonchitis</i>	Northern hollyfern	S2		
<i>Pyrola picta</i>	Whiteveined wintergreen	S2		
<i>Pyrrocoma crocea</i> var. <i>crocea</i>	Curlyhead goldenweed	S2	✓	✓
<i>Sisyrinchium pallidum</i>	Pale blue-eyed grass	S3		✓
<i>Sparganium natans</i>	Small bur-reed	S2		
<i>Sphagnum</i> spp.	Sphagnum moss (various species)	varied	✓	✓
<i>Trichophorum pumilum</i>	Rolland's bulrush	S1		✓
<i>Trillium ovatum</i> ssp. <i>ovatum</i>	Pacific trillium	S2	✓	✓
<i>Viburnum edule</i>	Squashberry	S2	✓	

(NRIS 2012, USFS 2015, WYNDD 2015, NatureServe 2017)

¹ **Status Codes** (NatureServe 2011): **S1**=critically imperiled in the state; **S2**=imperiled in the state; **S3**=vulnerable in the state; **SNR**=not ranked/under review; **SH**=possibly extirpated in the state.

VI. EFFECTS ANALYSIS FOR RARE PLANT SPECIES

Effects of Alternatives on Rare Plant Species

In the LaVA analysis area there are many reported occurrences of sensitive species from the list above, and the area is likely to contain further undiscovered populations. In addition, the analysis area contains suitable habitat for at least 4 Sensitive species with no known or as-of-yet discovered populations (Table 6). There are also 40 plant species of concern that are documented in the project area. In the Affected Environment section starting on page 13 of this document, the existing condition of rare plants on the Snowy Range and Sierra Madre units is discussed in detail. This section includes a table documenting which Sensitive species are known from each project accounting unit and how rare plants are distributed between habitats types. The following effects analysis will discuss the effects of proposed project actions on rare plants and areas of botanical concern in broad and general terms, since the precise location and/or amount of treatment in each accounting unit has not yet been determined. Biological determinations and effects for each sensitive species will be given on project-wide basis, but also summarized by accounting unit for reporting purposes (Appendix 1). The ultimate goal is to discover and protect all sensitive and other rare plants in the project area, but due to the considerable size of this project and the relative difficulty (or unlikelihood) of achieving a 100% detection rate, effects to sensitive species and rare plants are likely to occur. In addition, all suitable habitat for sensitive species cannot be avoided and adverse effects to these habitats cannot be adequately mitigated through project planning or with the use of design features because these habitats, such as old-growth and mature conifer forests and the sagebrush steppe and foothills, are the focus of some proposed treatment types.

Direct and Indirect Effects

Alternative 1: No Action

The No Action Alternative represents existing conditions in the LaVA analysis area, including the condition of the forest ecosystem, the current road system and the ongoing disturbance in the area. The mountain pine beetle (MPB) epidemic has killed off large portions of the canopy across the National Forest. Tree mortality is extremely variable and can be <20% to >80% of total canopy. This large-scale canopy die-off has created changing conditions on the forest floor, altering habitat for some rare reducers (shade-loving plant species; see Affected Environment on page 13) and likely making it less suitable. These habitats are typically experiencing an increase in light to the forest floor, which can increase soil surface temperatures and evaporation rates. More water, especially snow, is reaching the ground rather than getting caught by tree branches, but it may melt earlier due to sun exposure. Additionally, more water may be available to understory plants because there are now fewer live trees transpiring. These changed conditions may have negative effects on the rare reducers in this analysis, but the extent of the adverse impact the opened canopy will have on each species or known population is not well understood. Human activities, including logging and illegal collection, have always posed a risk to rare understory plants to some extent, but now the natural, changing conditions of the forest are also having adverse impacts on rare reducers. The resiliency of these species, especially when exposed to multiple perturbations is unknown.

Tree mortality from MPB has also contributed to changing fuel models. High temperature wildfires could have adverse effects to suitable rare plant habitat and populations by destroying plants and propagules. Wildfires could also create high ground temperatures that could sterilize the soil and eliminate the mycorrhizal fungal species on which some sensitive plant species depend for survival. A less intense fire,

however, could have positive impact on some sun-loving species and habitat by reducing shading and removing biomass, opening up new space for colonization (Juenger and Bergelson 1997, 2000, Proctor and Roche 2004). The potential for high fire intensity in lodgepole pine stands affected by bark beetles is greatest in the first years of the epidemic due to increases in fine fuels but decreases shortly after the epidemic phase and increases again decades later as snags fall creating a fuel matrix and regeneration occupies the canopy (Lynch et al. 2006, Jenkins et al. 2008). Currently the analysis area is in the second phase of the epidemic with lower fuel loading and wildfire potential, but if the area is not logged, will soon reach the third phase of fallen snags and ladder fuel matrices. However, other research has shown that the forest types affected by mountain pine beetle are naturally prone to severe, stand-replacing fire even in the absence of insect outbreaks (Romme et al. 2007) and many sensitive species that inhabit these habitats may be adapted to withstand fire (in the absence of post-fire weed invasion).

Under this alternative no new temporary roads, landings or skid trails would be created, which would lower soil disturbance and soil compaction, decrease direct destruction of native plants, and eliminate erosion associated with these features. Because these activities will not occur, the no alternative will have a lower impacts on native vegetation from soil disturbance such as erosion and compaction.

Since wetland habitats occur in forest openings and along riparian areas (where canopies do not usually consist primarily of lodgepole pine) the No Action Alternative would likely have no direct or indirect effects on these habitats. This is with the exception of high intensity wildfire, which may, if hot enough, burn the organic-rich soils of wetlands (such as fens). However, this is an unlikely scenario and diversity in some wetlands has been shown to increase post-fire (Ratchford et al. 2005). The No Action Alternative represents existing conditions in the LaVA analysis area, including the condition of the forest ecosystem, the current road system and the ongoing disturbance across both units.

Alternative 2: Modified Proposed Action

This analysis considers potential direct, indirect, adverse and beneficial effects of the modified proposed action on Forest Service R2 Sensitive plant Species and Plant Species of Concern. Effects to the species carried forward in this analysis are discussed by habitat type (old growth and mature forest types, foothills and shrub steppe, and wetlands (including fens, riparian areas, etc.)). Habitat identifiers for each plant species and Accounting units in which they occur are identified in Table 4. Potential threats and biological determinations for sensitive species are summarized in Table 10 and Appendix 1.

The direct effects of logging operations to rare plants is expected to be greatest in forested habitats, as these are the settings in which project activities are most likely to occur. Rare plants in these habitats occupy the understory and are all classified as either shrubs, forbs or grasses. Direct effects include trampling of individuals by machinery, resulting in breaking, crushing and/or uprooting of understory plants. Individuals may be covered or smothered by slash, chips, or soil and may have trees fall on them. A study in beetle-killed lodgepole pine stands in Colorado found that salvage logging decreased understory cover of forbs and grasses by approximately 50% (Rhoades et al. 2018). Impacts may occur during the harvest portion or during any post-harvest (especially mechanical) site-preparation activities and can physically damage individuals, populations, and/or the habitat where they grow. This may reduce growth, development, or seed set and/or may also cause mortality of individuals. Impacts to individual plants can reduce population size, change metapopulation structure, and cumulatively (with other projects/activities/impacts) may potentially affect viability of the species on the planning unit or range-wide. Forested habitats will need to be thoroughly surveyed to find and prevent impacts to currently undiscovered populations though the use of avoidance design features (Table 2. Design Features in LaVA DEIS relevant to the conservation of rare plants, rare plant habitats and native vegetation, page 10).

Canopy removal (of a sort) in many of these areas is happening naturally as part of the tree die-off from mountain pine beetle and other tree disease epidemics, but hastening this process is not recommended. Gradual tree die off and the presence of standing dead material provides some degree of shade to wetland and forest understories while allowing time for a new generation of trees to develop. Mechanical removal of dead material and thinning of live trees is not expected to aid or enhance these natural processes in a manner that benefits rare plants or habitats and mechanical treatment in these areas may rut or compact the soil, additionally damaging vegetation and hydrology, as described in the following paragraphs.

Wetlands, riparian areas and associated vegetation may be the most vulnerable rare plant habitats in the analysis area because they are the most uncommon on the landscape and can be easily damaged by canopy removal and operation of heavy machinery. Direct effects occur in the form of trampling, crushing and substrate disturbance (i.e. uprooting and burial). The standard timber contract provisions typically protect plant species occurring in wetlands from these types of direct effects, however indirect effects may still occur as a result of winter operations and mechanical treatments directly adjacent to marked wetlands. Fens are additionally protected by Region 2 policy in the Forest Service Manual Supplement No. 2600-2011-2, but still must be located on the ground in order to be avoided.

Indirect effects to wetland habitats include changes in hydrology as a result of operations in wetland buffers and/or contributing area. The trees in forested wetlands and forested wetland buffers retard water losses by shading the area and lowering temperatures and evaporation rates, but also contribute to water losses through transpiration (Mitsch and Gosselink 2007). The removal of tree canopies in wetlands will affect the water balance and the wetness of each wetland in ways that are unpredictable without involved study of each site. Altering the hydrology of wetlands will negatively affect rare plant species dependent on wetland habitats by decreasing the number, amount and extent of suitable habitat in the project area. The appearance of the wetland may also change slowly over time as a shift in vegetation communities occur. Known wetlands and buffered perimeters will be excluded from project implementation areas. However, wetland mapping errors may exist and logging equipment may travel through or around the edges of wetland habitats in order to access treatment units, timber landings, or decks. Therefore these habitats, where included in or adjacent to timber treatment units, will also be surveyed to find and prevent impacts to rare plant species.

Use of logging machinery and haul trucks may result in several direct impacts to soils that also affect native plants, including increased soil compaction (particularly wet soils) and creating ground disturbances that result in erosion. Soil compaction hampers seedling emergence (Thill et al. 1979). Erosion removes nutrients, and exposes lower soil horizons which are unsuitable for colonization by most rare species. These soil disturbances will likely be detrimental to mycorrhizal relationships needed by some rare plant species (Goss and DeVarennes 2002).

Indirect effects of logging operations may result from changes made to forest habitats by removal of trees or damage to vegetation and soils. Habitat/forest structure modifications may cause shifts in hydrologic, solar, and soil characteristics of rare plant habitats, and may also impact soils and soil mycorrhizae associated with rare plant species. Alteration of vegetation structure is a significant component of several specific treatments in the proposed action. Removal of the tree canopy increases solar radiation at the ground and can cause sites to become warmer and drier. Effects of dropping, lopping and scattering these materials is less clear and varies with the amount of slash left on the ground. Light amounts of slash may create warmer, drier conditions while heavier amounts of slash may create shading that increases microsite moisture and humidity. Forest management activities such as timber treatments and fuels reduction have been found to generally decrease plant abundance in the

understory (Rhoades et al. 2018). As with the direct effects, these effects are most likely to affect plant species that occur in forested habitats.

Logging operations and other timber management activities may have a long-term beneficial effect for plant species that prefer more open, non-forested conditions. Similar management activities elsewhere on the Forest have resulted in an increase in flowering plants in the understory that could benefit insect pollinators. Some species, such as moonworts, rely on mild disturbance for colonizing new areas. Disturbances and land management activities may create and maintain suitable habitat for these species or may negatively impact existing populations depending on the disturbance timing, intensity and frequency (Zika et al. 1995, Muller 2000, Williston 2001, Beatty et al. 2003). The temporary road construction and ensuing obliteration that are part of this proposal may create colonization opportunities for moonwort species. However, it is possible that long-term beneficial effects to some plants and pollinators may not offset losses from trampling, excessive soil disturbance, and noxious weed introduction and spread. Significant ground disturbance may damage above- and/or below-ground growth of moonworts, and also negatively affect mycorrhizal relationships necessary during all stages of moonwort life cycle (Vanderhorst 1997). In addition, opening the forest canopy can alter forage condition and quality, leading livestock and wildlife to modify foraging behavior. Opening the forest canopy can result in increased forage and result in more intense use of the area. Rare species may be impacted by livestock and/or wildlife as they graze in or travel through the area. Pollinators may experience more competition if floral resources are consumed by livestock and/or wildlife.

Timber and fuels treatments could reduce fuel loads in the project area and may reduce the risk of high severity fires in treatment units. For this reason, these actions could lower the potential for irreversible and irretrievable effects from a major wildfire (such as soil and seed bank sterilization). However, other research has shown that the forest types affected by mountain pine beetle are naturally prone to severe, stand-replacing fire in the absence of insect outbreaks (Romme et al. 2007) and many sensitive species that inhabit these habitats may be adapted to withstand fire.

Although the proposed management activities would alter the distribution, quantities and qualities of the fuel loading, it would not prevent wildfire - just affect fire behavior. Areas that have recently been treated by mechanically lopping and scattering slash may burn more readily and with high soil surface temperatures due to the large amounts of fine fuels close to the ground. Treated areas may serve as fuel breaks to retard the spread of wildfire, or they may burn continuously and be ineffective as a control mechanism. Wildfire could have short term adverse impacts on plant species in forested habitats as well as their insect pollinators that rely on native vegetation communities and nesting sites in the area. Long-term impacts could be beneficial, as fire can encourage growth in many native plants species, or it could be adverse if invasive plant species move into the area post-fire, or if rare species that are not fire adapted are burned. Wildfire typically burns patchily and with lower severity through wetlands, having little effect on wetland plant species. It is also very uncommon for weeds to colonized wetlands post-fire in this region, so wetland plant species are less likely to be affected by changes in fuel loading and wildfire behavior in the project area. The most likely impact to wetlands in the event of fire, prescribed or wild, is from the installation/creation of fire line or fire breaks. These are typically made by hand or with heavy equipment and can cause significant soil disturbance. This disturbance can physically damage wetlands and wetland plants, but more commonly may disrupt the water table by diverting or altering flow patterns and amounts. For this reason, design features prohibit the construction of fire lines and fire breaks in wetlands during the implementation of prescribed fire.

The foothills and shrub steppe have the potentially to be most affected by prescribed burning. Under ideal situations (no invasive plants, no soil sterilization or widespread destruction of propagules) prescribed fire can be beneficial for these ecosystems, but in recent years the post-fire spread of

cheatgrass and other invasive plants has proven to be damaging to soils and disrupted or prevented the regeneration of native plant communities. This large-scale habitat conversion from native vegetation to non-native invasive vegetation poses a threat to rare plant species. Careful planning of prescribed fire and use of the design features requiring the control of cheatgrass and noxious weeds (where appropriate) will be necessary to help prevent non-native plant invasion, maintain native species diversity in the foothills and shrub steep and support rare plants post fire.

Introduction of invasive plant species poses a threat to all plant and habitats evaluated in this report (with the exception of wetlands). Colonization by noxious weeds and other invasive species can lead to detrimental habitat changes over time. Noxious weeds can indirectly impact rare plant species through allelopathy (the production and release of plant compounds that inhibit the growth of other plants) (Ridenour and Callaway 2001), changing fire regimes (making wildfire intervals too frequent for native species' tolerances), and through direct competition for light, nutrients, or water. Subsequent weed control efforts (primarily hand pulling or herbicide application) could also negatively impact rare plant species by killing them from herbicide over-spray, poorly targeted applications, improper chemical choice, and other means, such as uprooting. Many native plants are more sensitive to the effects of herbicide than their invasive counterparts and herbicide applications can often create a "donut" pattern of incidental native plant death around each treated weed. Selective herbicides, such as those designed to prevent germination of invasive annual bromes, are often applied aerially and can cause large-scale damage or mortality in native plants when application rates are too high or overlap of applications occurs. Additionally, there is evidence that some native annual plants can be adversely affected by selective herbicide because these pre-emergent herbicides damage the germinating seeds of annual native plants as well as annual non-native plants. Design criterion and BMPs for washing equipment prior to working on site and using certified weed-free materials may reduce but not necessarily eliminate the introduction of new populations. Additionally, design criterion requiring the testing of native seed to prevent the introduction of weed seeds will be beneficial in the same manner.

Finally, the modified proposed action proposes up to 600 miles of temporary road construction. Temporary road construction as well as the construction of timber landings and decks has direct adverse effects on native vegetation and the soils and water tables on which they depend. This extensive amount of temporary road construction will result in the destruction of large amounts of native vegetation. It will also result in soil disturbance, soil compaction, erosion of sediment, and, in some cases, the disruption or disturbance of hydrologic flows/water tables. Native vegetation, including rare plants, can be damaged or destroyed by soil disturbance and erosion and can be indirectly impacted by changes to site conditions caused by altered soils and water tables. Native species are also less successful at colonizing compacted soils or those that have been decommissioned but have mixed soil horizons and/or decreased organic matter content. Even after temporary roads, landings, and decks are rehabilitated it is unlikely that new native vegetation communities will resemble the lost vegetation communities, even after decades of regrowth.

Cumulative Effects

Past, ongoing and reasonably foreseeable actions in the project area may also have an impact rare plants and suitable habitats. These actions can have many of the same adverse and beneficial impacts as described above, but species resilient to singular disturbances may be vulnerable when impacted by multiple actions and perturbations.

Table 8 shows that 113,359 acres of harvesting activities occurred within the analysis area since 1960 (36,873 on the Laramie Range District and 76,486 acres on the Brush creek Hayden Ranger District) according to the Forest

Service FACTS database. Approximately half (55,470 acres) of the acres were harvested using clearcut methods. Aerial photography shows the patchwork of vegetation treatments that has occurred within the AA.

Table 9 lists planned present and future timber activities. Timber activities are one of the major disturbances that impacts rare plant species, but other activities may have impacts as well.

Table 8. Past Timber Treatments in the Analysis Area (since 1960).

Laramie Ranger District		Brush Creek Hayden Ranger District	
Treatment	Acres	Treatment	Acres
Commercial Thin	1019	Commercial Thin	3962
Group Selection Cut (UA/RH/FH)	388	Group Selection Cut (UA/RH/FH)	766
Overstory Removal Cut (from advanced regeneration) (EA/RH/FH)	4187	Improvement Cut	2
Patch Clearcut (EA/RH/FH)	418	Overstory Removal Cut (from advanced regeneration) (EA/RH/FH)	7236
Salvage Cut (intermediate treatment, not regeneration)	2306	Patch Clearcut (EA/RH/FH)	3345
Sanitation Cut	1155	Salvage Cut (intermediate treatment, not regeneration)	1299
Seed-tree Removal Cut (w/ leave trees) (EA/NRH/FH)	51	Sanitation Cut	6750
Shelterwood Establishment Cut (with or without leave trees) (EA/RH/NFH)	229	Shelterwood Establishment Cut (with or without leave trees) (EA/RH/NFH)	1281
Shelterwood Preparatory Cut (EA/NRH/NFH)	4407	Shelterwood Preparatory Cut (EA/NRH/NFH)	15255
Single-tree Selection Cut (UA/RH/FH)	1716	Shelterwood Removal Cut (EA/NRH/FH)	659
Stand Clearcut (EA/RH/FH)	20997	Shelterwood Removal Cut (w/ leave trees) (EA/NRH/FH)	235
Laramie RD Total	36,873	Single-tree Selection Cut (UA/RH/FH)	1148
		Stand Clearcut (EA/RH/FH)	34473
		Two-aged Shelterwood Establishment Cut (w/res) (2A/RH/NFH)	75
		Brush Creek Hayden RD Total	76,486

Table 9. Current and Foreseeable Future Timber Management Projects by Mountain Range.

Sierra Madre Range	Snowy Range
Box Canyon Reoffer 2 Timber Sale	Badger Creek Timber Sale
Capitol Timber Sale	Foxborough Timber Sale
Cerberus Timber Sale	HWY 130/CPL&L Settlement Sale
Chum Timber Sale	Lake Owen Timber Sale
Citadel Timber Sale	Porter Creek Timber Sale
Hell Canyon Timber Sale	Race Horse Reoffer Timber sale
McAnulty Reoffer 3 Timber Sale	Spruce East Timber Sale
Spinner Timber Sale	Cedar 261 Stewardship- Hazard tree clearing
Patriot Stewardship	Brooklyn Nash Stewardship- Hazard tree clearing
Skyline 415 Stewardship- Hazard tree clearing	Caixa Stewardship- Hazard tree clearing

Biological Evaluation of Plant Species

Zarb Stewardship- Hazard tree clearing	NFSR 542 Beaver Stewardship-Hazard tree clearing
Divide Peak Prescribed Burn	Bald Mountain Prescribed Burn
Sandstone Prescribed Burn	Mill Creek Prescribed Burn
Battle Mountain Prescribed Burn	Fox Creek CE
Ryan Park CE	

Other types of past, present and reasonably foreseeable future actions that may impact rare plants in the LaVA analysis area include epidemic tree disease, wildland fires, weeds treatments, transportation projects, recreation, grazing, and other miscellaneous projects. Some major actions in the project area are as follows:

- Unit-wide epidemic tree disease
 - Mountain Pine Beetle and Spruce Beetle
- Wildfire (natural ignition and human-caused)
 - Hell Canyon, Squirrel Creek, Owen, Keystone and Beaver Creek Fires, etc.
 - Fire suppression activities
- Prescribed Burning
- Travel management
 - Road decommissioning, road closures
 - Road maintenance and repair
 - Construction of new roads and motorized trails
- Noxious weed treatments
 - Squirrel Creek aerial cheatgrass treatment
 - Roadside spot treatment of noxious weeds
- Recreation
 - Motorized and non-motorized recreation activities
- Livestock Grazing
- Water diversion
 - Ditches, reservoirs, pipelines
- Various permitted activities
 - Power and light infrastructure, cellular towers, etc.
- Climate change
 - Changes in temperature, precipitation patterns and amounts, and phenology

The effects of these types of activities on plant species are as follows:

- Grazing leads to biomass removal and trampling. It has led to changes in species composition, compaction of soils, changes in fuel loading and the fire regime, down-cutting of riparian areas with subsequent drying of adjacent meadows, and noxious weed invasion. With riparian areas and wet meadows livestock grazing has led to churning of the soil and pugging which changes soil and water characteristics and often alters native plant communities.
- Timber harvest and thinning has led to a more open canopy with additional light and water reaching the forest floor (which may be beneficial or detrimental depending on the species), soil disturbance and compaction, development of skid roads, and noxious weed invasion. Changes in forest composition, structure and fire frequency have also taken place.

- Insect and disease outbreaks are natural events that occur periodically, although current levels are more wide-spread than other times in the historical record. Such outbreaks lead to tree mortality, creation of forest-gap habitats, opening of meadow habitats, and potentially to stand-replacing fires. It can also lead to a more open canopy and effects to plants related to this change.
- Fire suppression has led to increased fuel loading, canopy closure, and higher intensity wildfire. It has also compacted and disturbed soils and altered native plant communities where fire lines and breaks were created. Vehicles used in fire suppression can also spread noxious weeds.
- Prescribed fire can decrease fuel loading, open the forest canopy and ultimately may sometimes lower the intensity of wildfire. It can also spread noxious weeds and cheatgrass (as can wildfire) which can lead to habitat conversion to non-native dominated communities that are not suitable for rare plants.
- Motorized and non-motorized recreational use (including OHV use, camping, horseback riding, mountain biking, hiking, hunting, and fishing) has led to the development of non-system roads and trails, development of dispersed campsites, erosion, sedimentation in water bodies, rutting and damage to wetland hydrology and vegetation, and the vectoring of noxious weeds in previously un-infested areas.
- Road construction causes soil disturbance and erosion, destruction of habitat, and noxious weed invasion. It also increases the impacts from recreational activities by allowing new and/or improved access for those activities. Road maintenance can reduce erosion by creating and retaining erosion control features and by lowering the instance of road braiding.
- Non-native plant invasion is often the result of the ground disturbing activities listed in the effects section above. These non-native species displace native plants, mostly through direct competition. In some cases highly competitive non-native species have been used in re-vegetation efforts, and these species are potent competitors for light, nutrients, and water.
- Water diversion has historically altered water tables and stream flows on a unit-wide scale.
- Climate change is expected to increase average temperatures across the units as well as changing precipitation patterns and amounts. This may result in more precipitation as rain vs. snow, earlier snowmelt, drier, hotter summers, and other changes. Vegetation communities may change over time as certain species are unable to survive, other changes may be more subtle such as altered phenology that mismatches plant life cycles with important seasonal patterns such as pollinator activity or seasonal rains.

If adverse effects are not minimized at the local level, cumulative effects may result. Past and present forest management activities have caused changes in plant community structure and composition across the forests. These management activities have altered the present landscape to various degrees and have had direct, indirect, and possibly cumulative effects on sensitive plant species and habitats.

Project-wide Biological Determinations for Sensitive Species

Biological determinations are given for each sensitive species under each alternative in Table 10 and by Accounting Unit in Appendix 1. Justifications for these determinations are discussed below.

Alternative 1: No Action

Under this alternative sensitive plants and suitable habitat for these species would continue to be impacted by past, present and ongoing activities on the forest. In many ways, these activities represent existing condition on the forest – conditions in which these plants have become rare (in some cases at least) but are still able to maintain population viability. This is specifically in reference to livestock grazing, recreation, the maintenance of roads, trails and water ditches, but even includes historic logging levels and past and present epidemic tree disease. In the absence of the modified proposed action there may still be future impacts to sensitive plants, either those from ongoing activities or from future planned activities such as other timber harvest. In addition, rare plants and habitats may be impacted in ways difficult to predict by our changing climate. Despite this, I believe the likelihood of adversely impacting sensitive plants is much lower under the No Action Alternative, because logging and temporary road building on an unprecedented large-scale would not occur. Even in the case of large-scale wildfire(s), impacts may be adverse or beneficial, depending on severity. Due to these factors biological determination for all Region 2 Sensitive plant species under Alternative 1: No Action is:

- **“No impact”** -- where no effect is expected.

Alternative 2: Modified Proposed Action

Despite past and future field survey efforts, well-crafted design features and timber sale contract provisions, it is highly probable that some rare plants will be affected by the modified proposed action. This is due to several factors 1) detection rate of sensitive plants, despite best efforts, is never 100% and there will be undetected and thus unprotected populations in the project area; 2) projects may not always be implemented according to plans and discrepancies may result in impacts to areas meant to be avoided. This has historically been true in regards to wetlands; and 3) projects will be planned in suitable and occupied sensitive plant habitat (such as mature forests). Project goals may supersede protection of natural resources and impacts to sensitive plants may be knowingly incurred, though kept to an acceptable threshold. Due to the large-scale and as-of-yet imprecise nature of the modified proposed action, it is difficult if not impossible to say with certainty how or to what degree Sensitive plant species may be impacted by the proposal as implementation rolls out over the next decade. It is not possible to say that plants will not be affected, nor is it possible to say with certainty that they will be negatively affected to a severe degree. It is the intent that the design features in this alternative will mitigate potential adverse effects to as great of an extent as possible. Therefore, the biological determination for all Region 2 Sensitive plant species under Alternative 2: Modified Proposed Action is:

- **“May adversely impact individuals, but not likely to result in a loss of viability in the Planning Area, nor cause a trend toward federal listing”** -- where effects in the project area are not expected to be significant, and the species and its habitat will remain well distributed.

Table 10. Biological Determinations for Sensitive plant species

Name	Habitat Types	Potential Threats				Biological Determination ¹	
		Trampling, Crushing, or Burying	Habitat Alteration /Canopy Removal	Hydrologic Alteration	Habitat Conversion by Invasive Species	No Action	Mod. Proposed Action
<i>Astragalus leptaleus</i> park milkvetch	Wetlands	x		x	x	NI	MAII

Biological Evaluation of Plant Species

Name	Habitat Types	Potential Threats				Biological Determination ¹	
		Trampling, Crushing, or Burying	Habitat Alteration /Canopy Removal	Hydrologic Alteration	Habitat Conversion by Invasive Species	No Action	Mod. Proposed Action
<i>Carex diandra</i> lesser panicled sedge	Wetlands, fens			x		NI	MAII
<i>Carex livida</i> livid sedge	Wetlands, fens			x		NI	MAII
<i>Drosera rotundifolia</i> roundleaf sundew	Wetlands, fens			x		NI	MAII
<i>Eleocharis elliptica</i> Elliptic spikerush	Wetlands			x		NI	MAII
<i>Eriogonum exilifolium</i> dropleaf buckwheat	Sagebrush steppe and foothills	x			x	NI	MAII
<i>Eriophorum gracile</i> slender cottongrass	Wetlands, fens			x		NI	MAII
<i>Festuca hallii</i> plains rough fescue	Sagebrush steppe and foothills	x			x	NI	MAII
<i>Ipomopsis aggregata</i> ssp. <i>weberi</i> Rabbit Ears gilia	Sagebrush steppe and foothills	x			x	NI	MAII
<i>Kobresia simpliciuscula</i> simple bog sedge	Wetlands			x		NI	MAII
<i>Machaeranthera coloradoensis</i> Colorado tansy aster	Sagebrush steppe and foothills	x			x	NI	MAII
<i>Rubus arcticus</i> ssp. <i>acaulis</i> dwarf raspberry	Old growth and mature forests	x	x		x	NI	MAII
<i>Salix candida</i> sageleaf willow	Wetlands, fens			x		NI	MAII
<i>Salix serissima</i> autumn willow	Wetlands, fens			x		NI	MAII

Biological Evaluation of Plant Species

Name	Habitat Types	Potential Threats				Biological Determination ¹	
		Trampling, Crushing, or Burying	Habitat Alteration /Canopy Removal	Hydrologic Alteration	Habitat Conversion by Invasive Species	No Action	Mod. Proposed Action
<i>Sphagnum angustifolium</i> Sphagnum moss	Wetlands, fens			x		NI	MAII
<i>Utricularia minor</i> lesser bladderwort	Wetlands			x		NI	MAII

¹**Biological Determination Codes:** **NI** = No impact – where no effect is expected, **BE** = Beneficial impact – where effects are expected to be beneficial, and no negative effects are expected to occur, **MAII** = May adversely impact individuals, but not likely to result in a loss of viability in the Planning Area, nor cause a trend toward federal listing – where effects in the project area are not expected to be significant, and the species and its habitat will remain well distributed, **LRLV** = Likely to result in a loss of viability in the Planning Area, or in a trend toward federal listing -- where effects are expected to be detrimental and substantial, and the species and its habitat will not be maintained in sufficient numbers or distribution through time.

Summary of Effects on Plant Species of Concern

Biological determinations are not required by agency-wide or regional Forest Service policy and may not be appropriate for Plant Species of Concern since rarity factors vary for this group of species. Therefore this section just gives a general summary of effects and an expectation for how the different alternatives may affect Plant Species of Concern. In addition, Appendix 1 gives summaries of effect for each PSoC in each Accounting Unit.

Alternative 1: No Action

In the absence of the modified proposed action there may still be impacts to PSoC, either those from ongoing activities or from future planned activities such as other timber harvests. In addition, rare plants and habitats may be impacted in ways difficult to predict by our changing climate. Despite this, I believe the likelihood of adversely impacting PSoC is much lower under the No Action Alternative, because logging and temporary road building on an unprecedented large-scale would not occur. Even in the case of large-scale wildfire(s), impacts may be adverse or beneficial, depending on severity. Therefore the summary of effect to Plant Species of Concern for Alternative 1 is:

- ***No impact*** – where no additional impacts to species will be incurred as a result of this alternative

Alternative 2: Modified Proposed Action

Similar to the discussion on Sensitive plant species, PSoC may be impacted by project activities despite best efforts to avoid these impacts. In addition, project goals may supersede protection of natural resources and impacts to PSoC plants may be knowingly incurred, and there is no acceptable threshold or limit to these impacts defined by policy for this group of species. Due to the large-scale and as-of-yet imprecise nature of the modified proposed action, it is difficult if not impossible to say with certainty how or to what degree PSoC may be impacted by the proposal as implementation rolls out over the next decade. It is not possible to say that plants will not be affected, nor is it possible to say with certainty that they will be negatively affected to a severe degree. It is most likely that the species that grow in old growth and mature forest types will be most impacted by logging, while those that grow in the

sagebrush steppe and foothills will be most impacted by the spread of weeds post-fire. It is the intent that the design features in this alternative will mitigate potential adverse effects to as great of an extent as possible. Therefore, the summary of effect to Plant Species of Concern under Alternative 2 is:

- ***May affect, not likely to negatively impact long term viability of these species on a forest-wide scale if surveys and design features are consistently implemented.***

VII. RESPONSIBILITY FOR A REVISED BIOLOGICAL EVALUATION

This Biological Evaluation was prepared based on presently available information. If the action is modified in a manner that causes effects not considered, or if new information becomes available that reveals that the action may impact endangered, threatened, proposed, or sensitive species that in a manner or to an extent not previously considered, a new or revised Biological Evaluation will be required.

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